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Koyama

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(54) **DEVELOPER STORAGE BODY, IMAGE FORMING UNIT AND IMAGE FORMING APPARATUS**

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G03G 21/16 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 21/1676*** (2013.01); ***G03G 21/1647*** (2013.01); *G03G 15/0832* (2013.01); *G03G 15/0837* (2013.01); *G03G 2215/0668* (2013.01); *G03G 2215/0692* (2013.01)

(58) **Field of Classification Search**
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USPC 399/262
See application file for complete search history.

(56) **References Cited**

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JP 2003-345116 * 12/2003 ..... G03G 15/08
JP 2003-345116 A 12/2003

* cited by examiner

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Assistant Examiner — Kevin Butler
(74) *Attorney, Agent, or Firm* — Rabin & Berdo, P.C.

(57) **ABSTRACT**

A developer storage body includes a first storage member, a second storage member, a frame and a resiliently deformable partition member. The first storage member includes a first opening, and a first flange provided along an outer periphery of the first opening. The second storage member includes a second opening, and a second flange provided along an outer periphery of the second opening so that the second flange faces the first flange. The frame includes a third flange held between the first flange and the second flange. A partition member includes a peripheral end portion fixed to the frame. The partition member and the first storage member form a first space portion therebetween. The partition member and the second storage member form a second space portion therebetween.

20 Claims, 14 Drawing Sheets

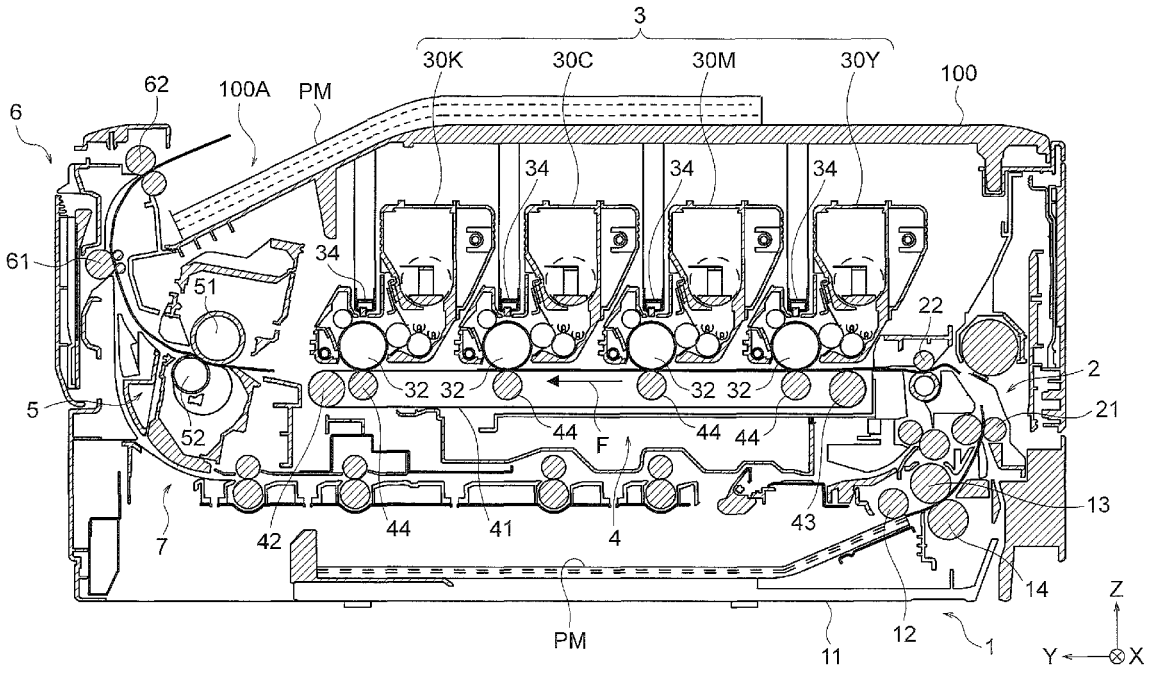
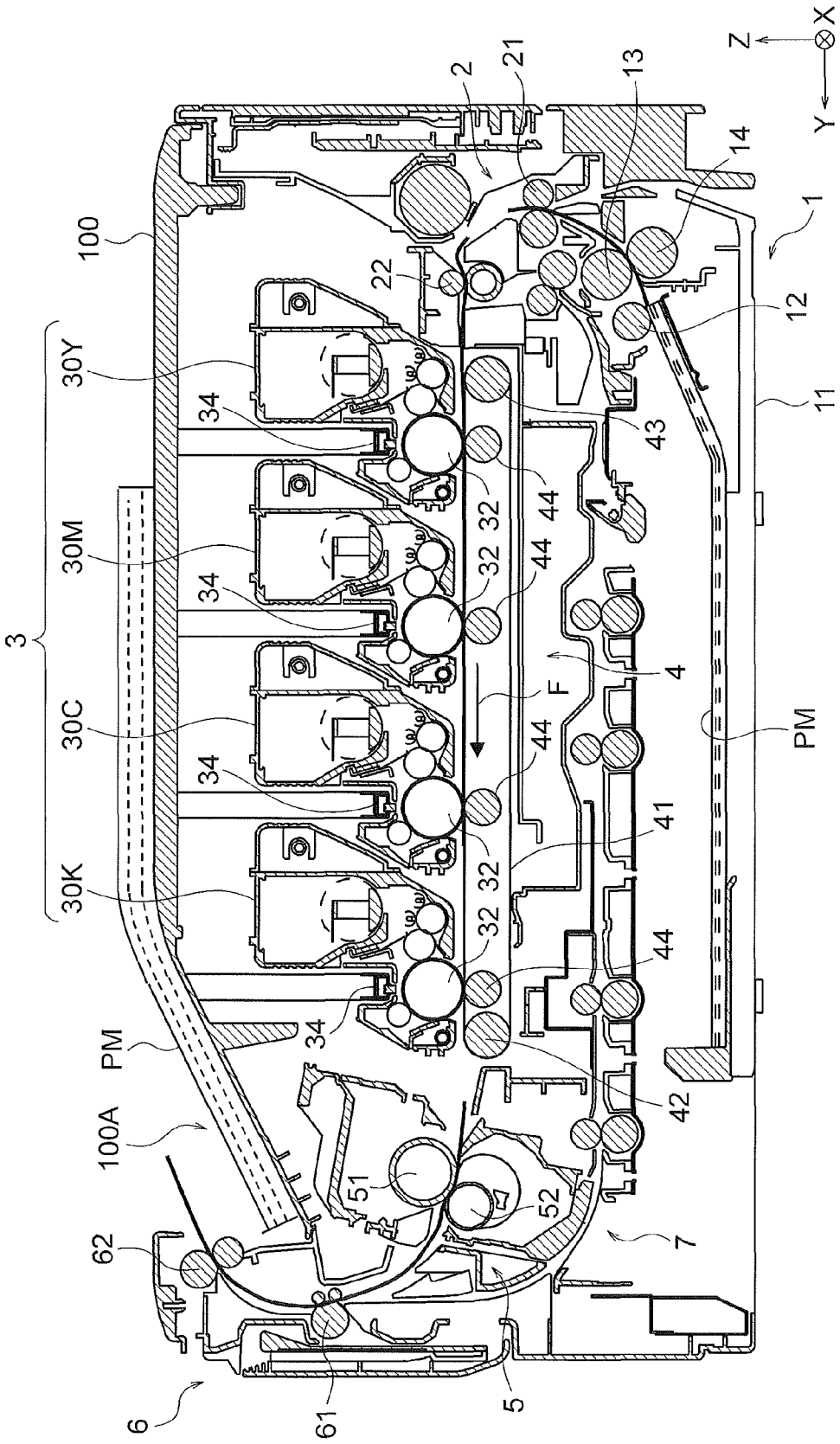


FIG. 1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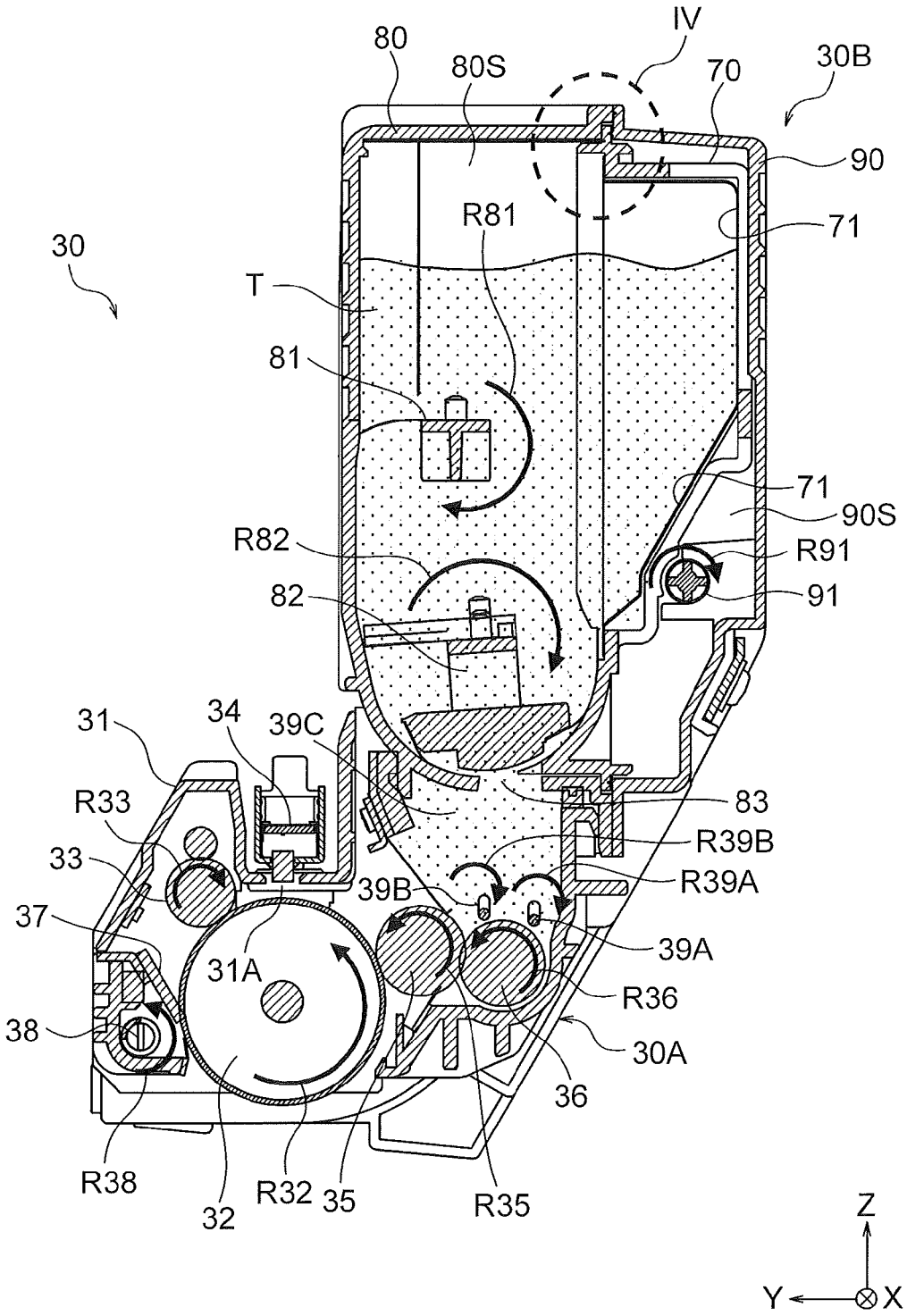
3

FIG. 2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R39B
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39B
R39A
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R38
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R32
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R35
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FIG. 3

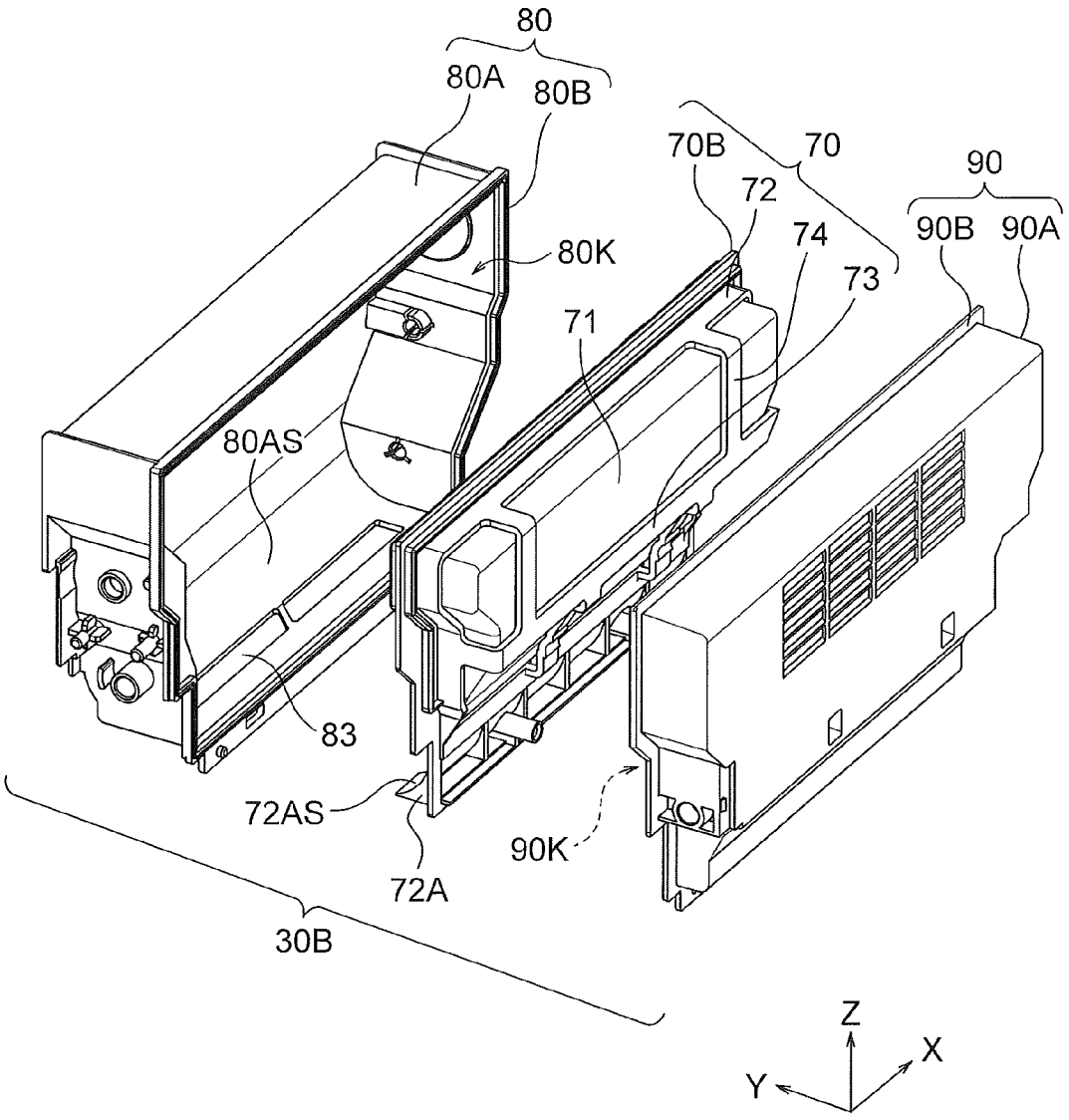
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FIG. 4

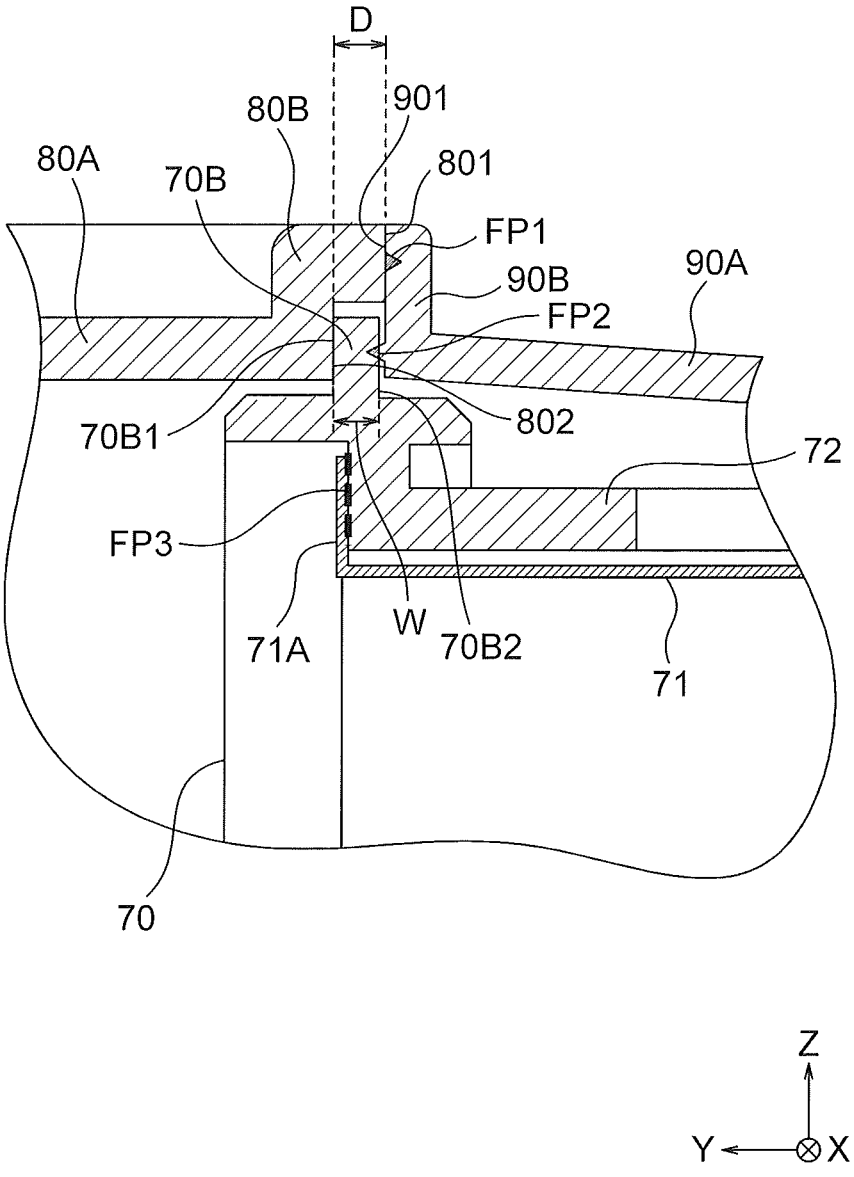
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FIG. 5

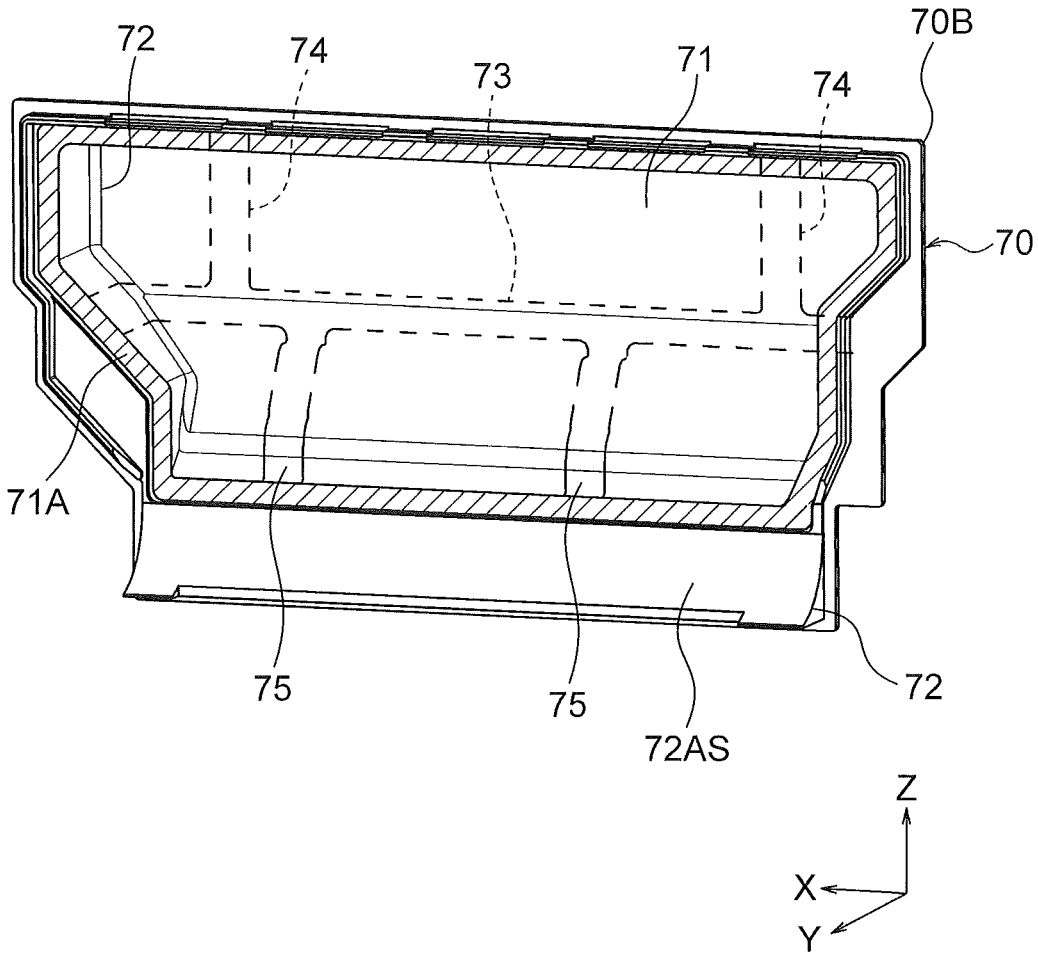


FIG. 6

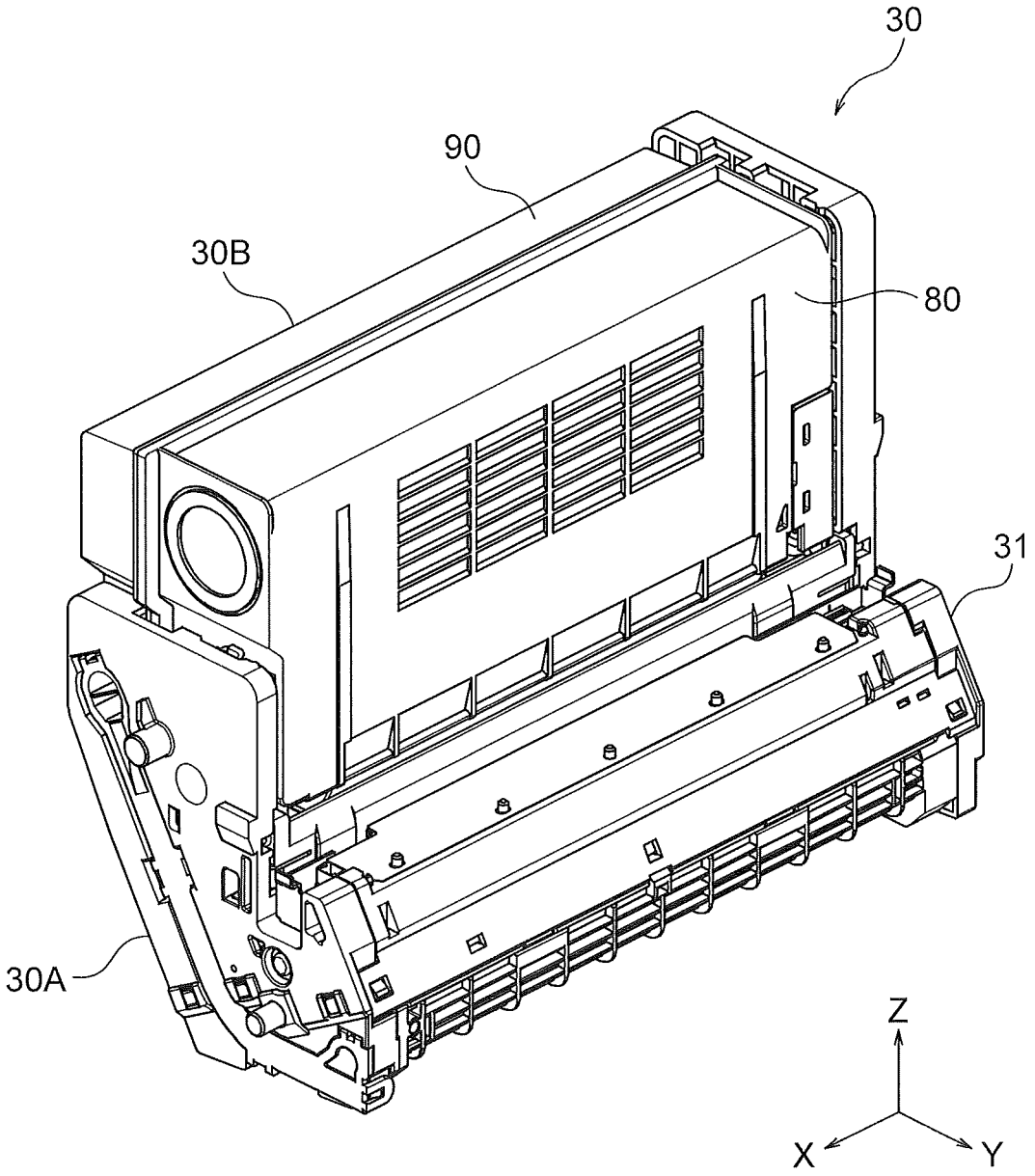
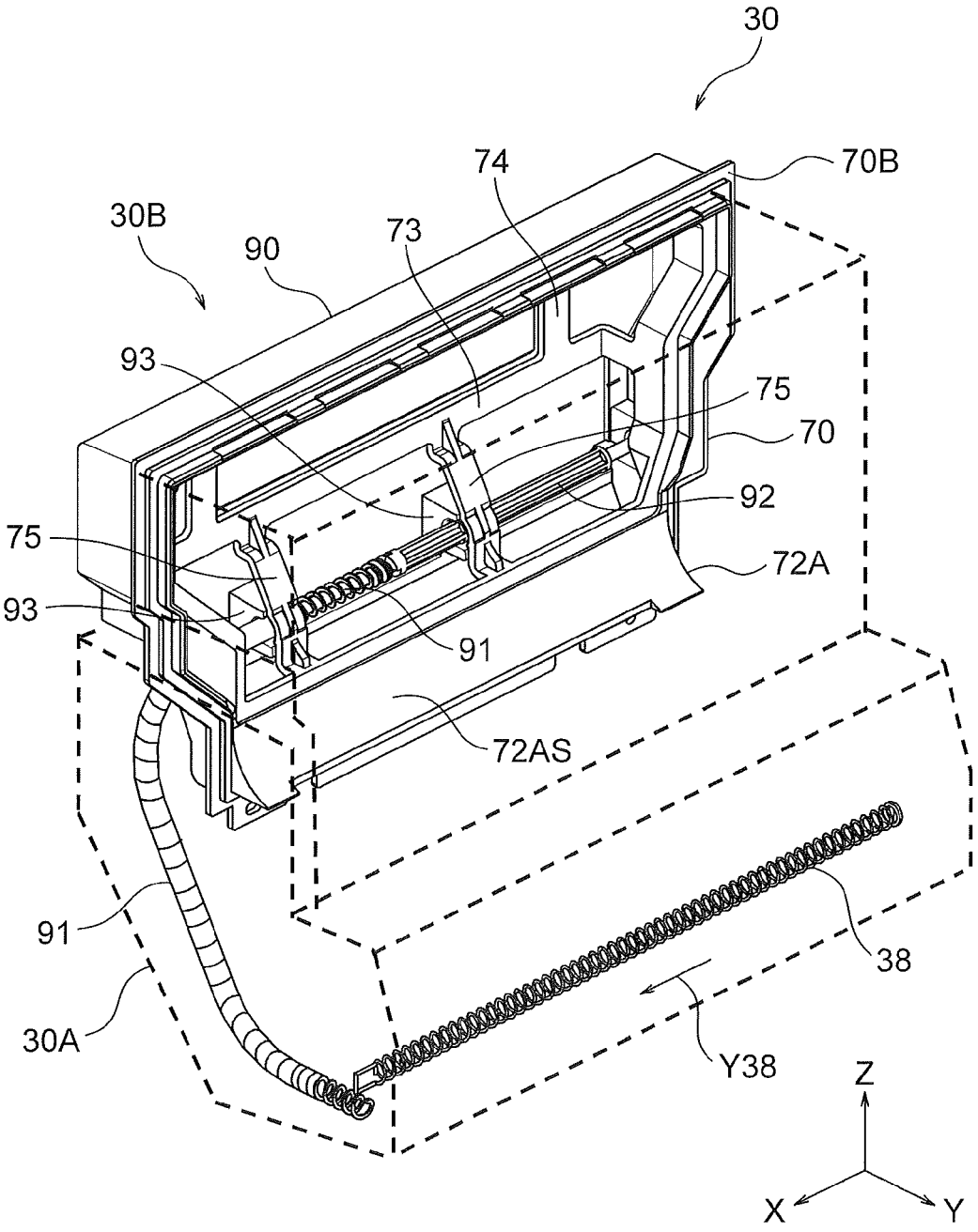


FIG. 7



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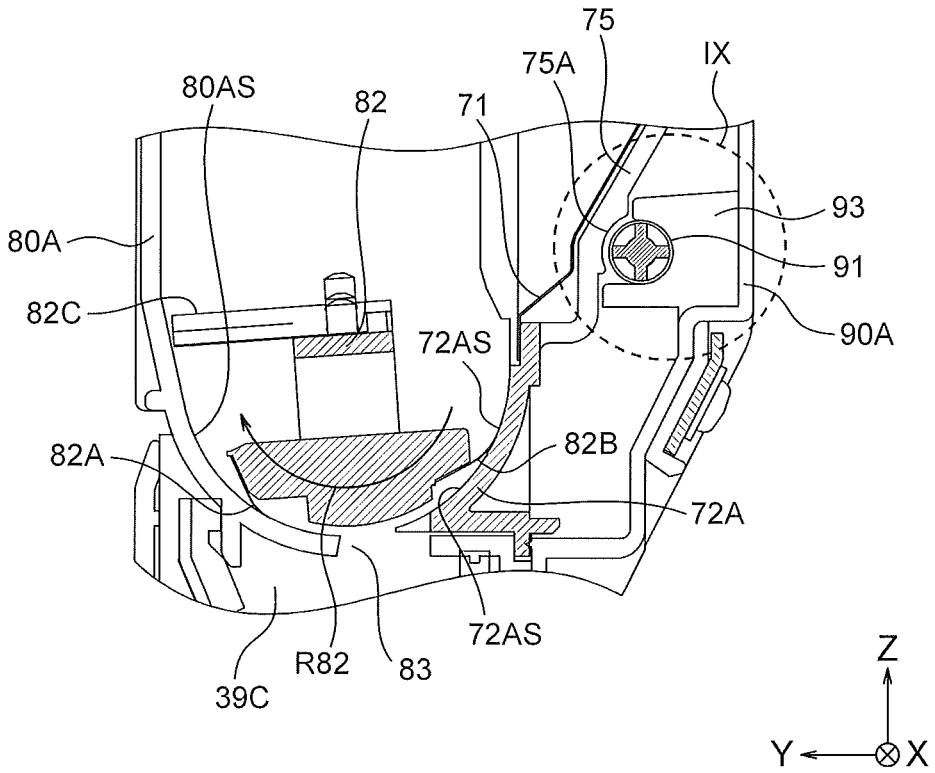
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82A
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72A
72AS
R82
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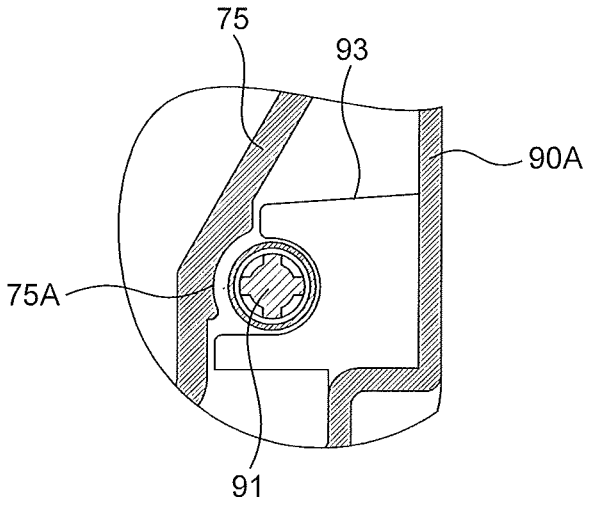
39C
Z
Y
X

FIG. 9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75A
91

FIG. 10

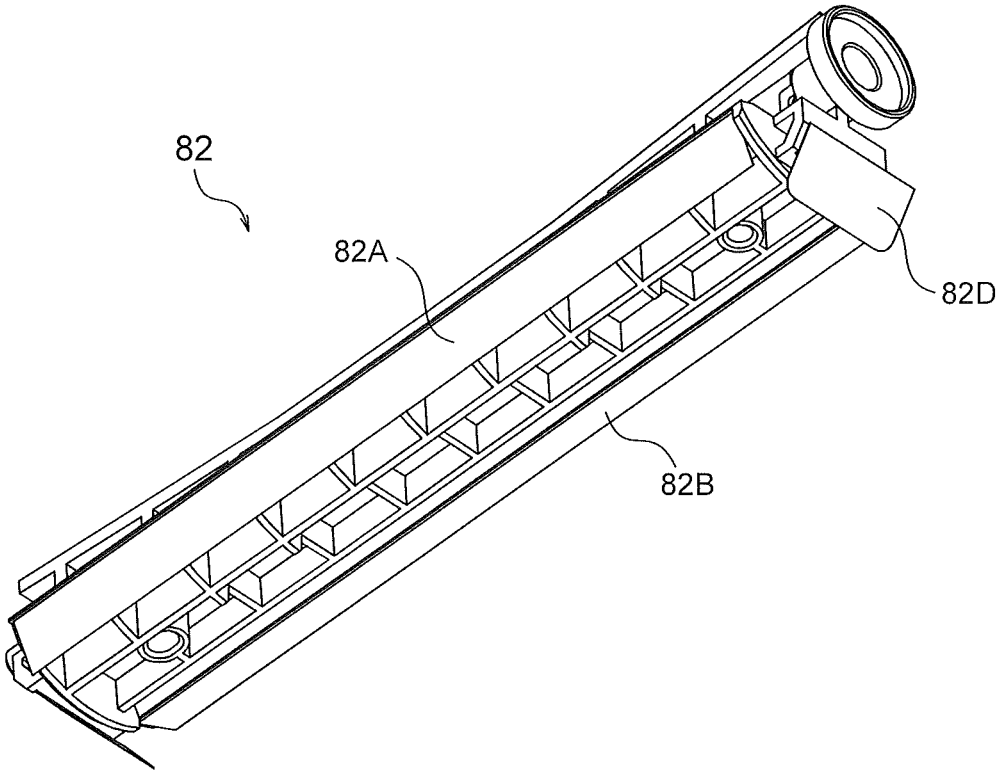
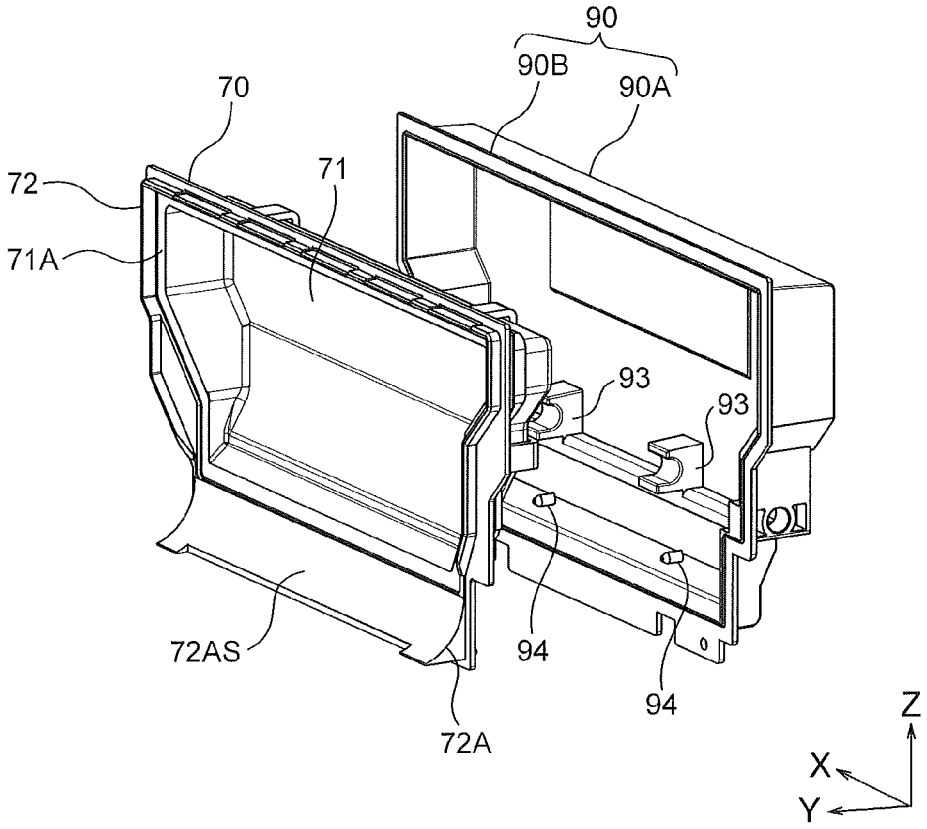


FIG. 11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94
72A
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FIG. 12

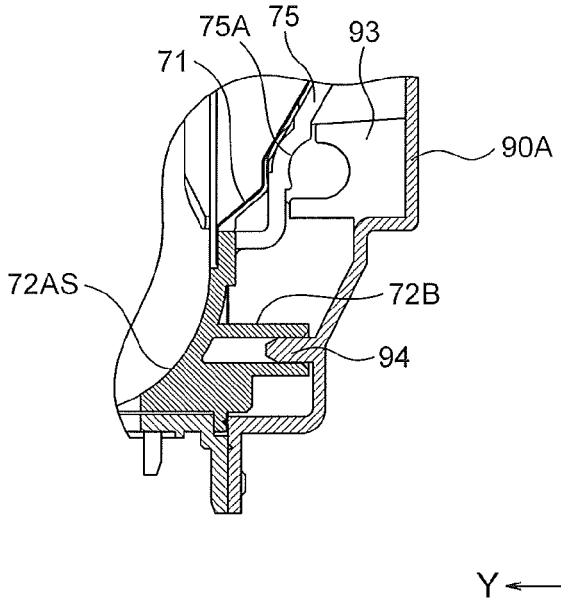
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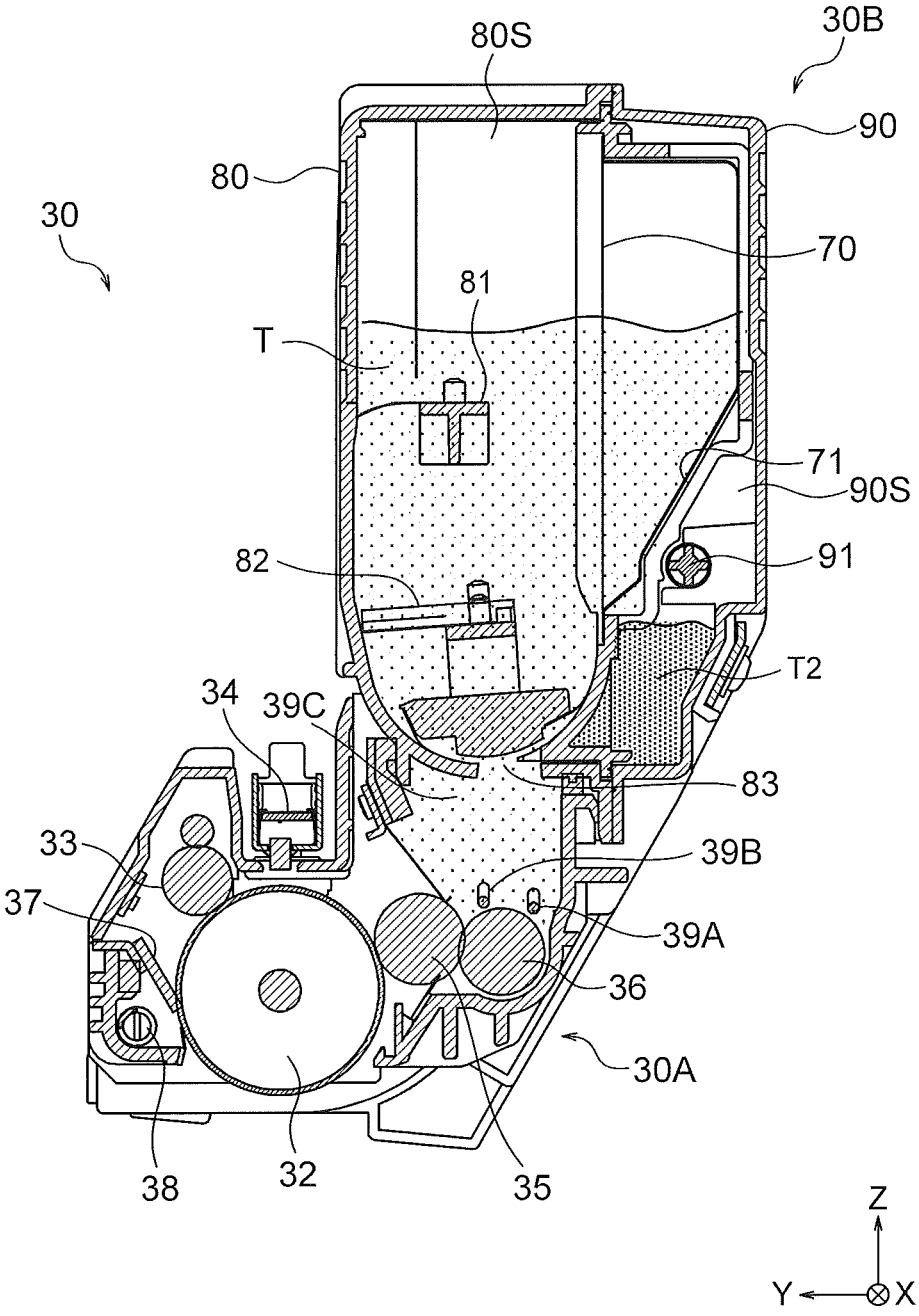
FIG. 13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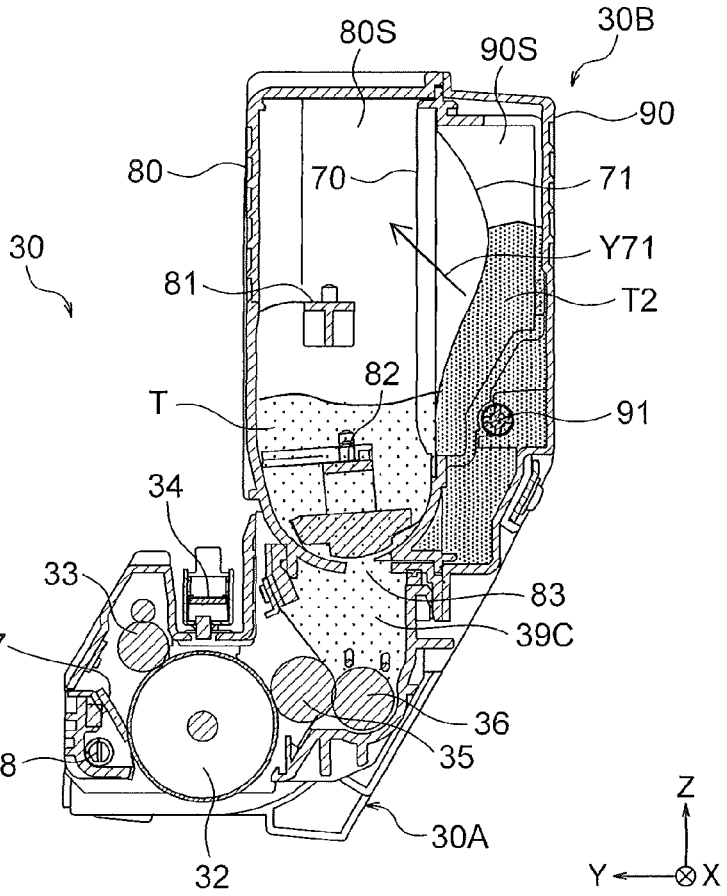
Y
X

FIG. 14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38
30A
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Z
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X

FIG. 15

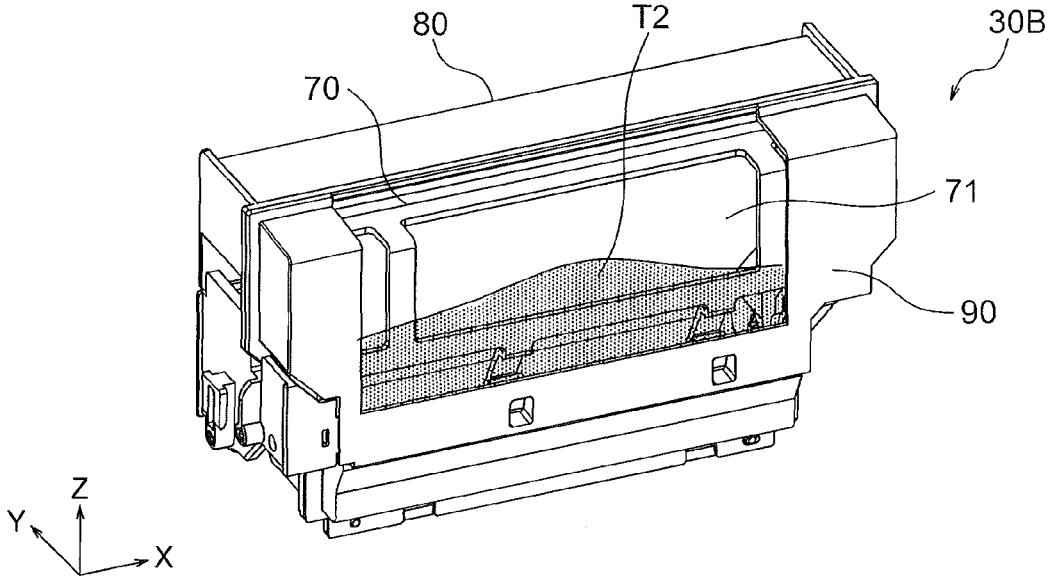
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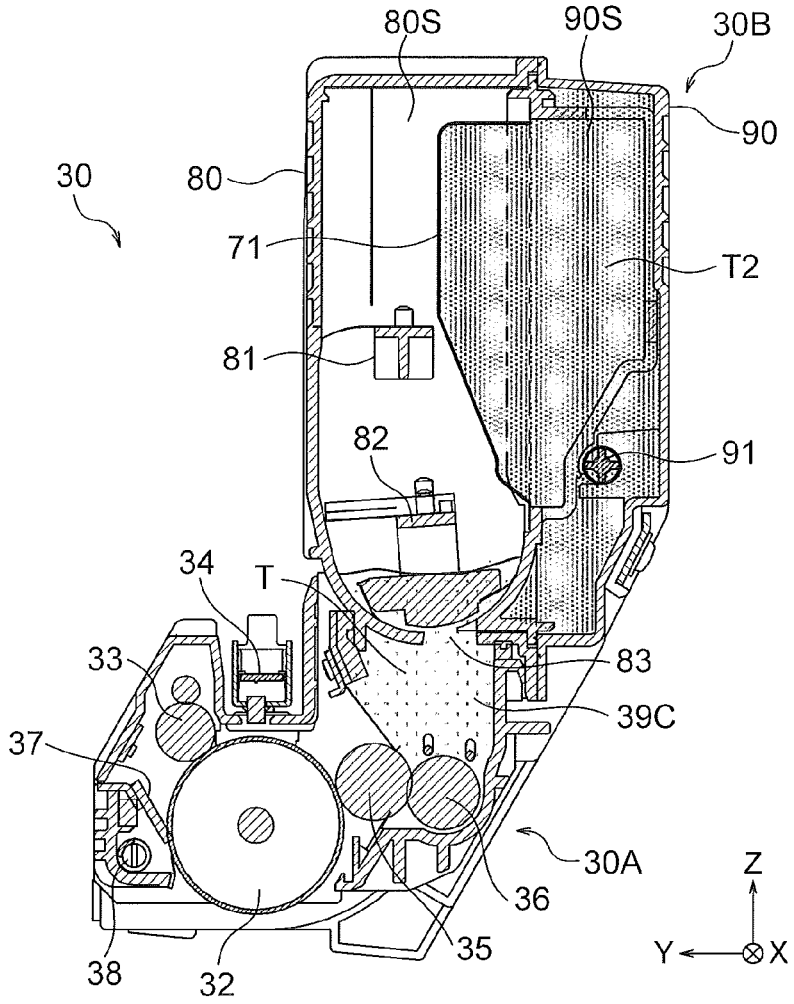
FIG. 16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35
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32
Z
Y
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FIG. 17

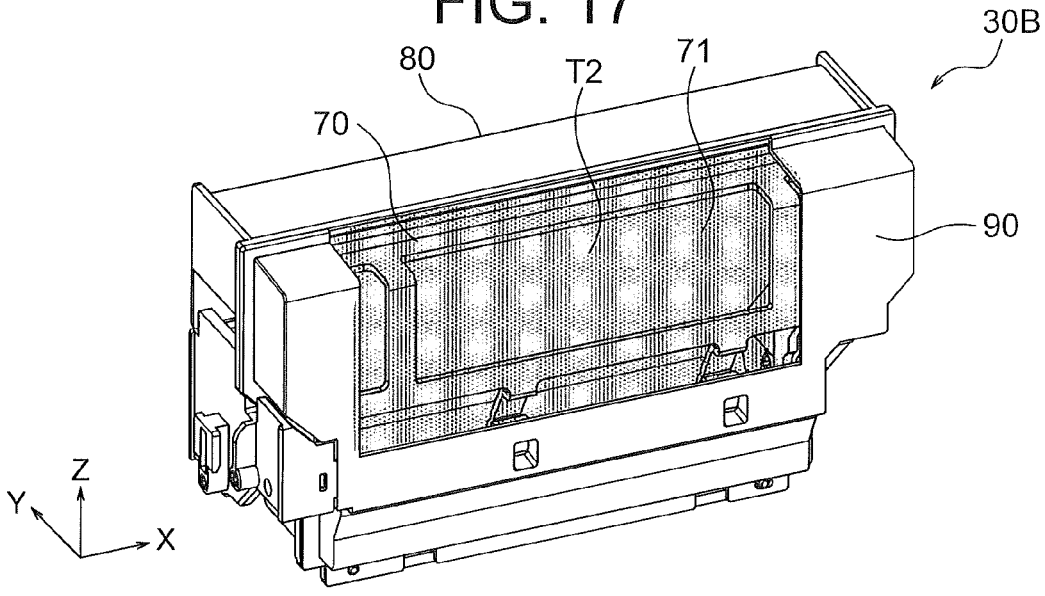
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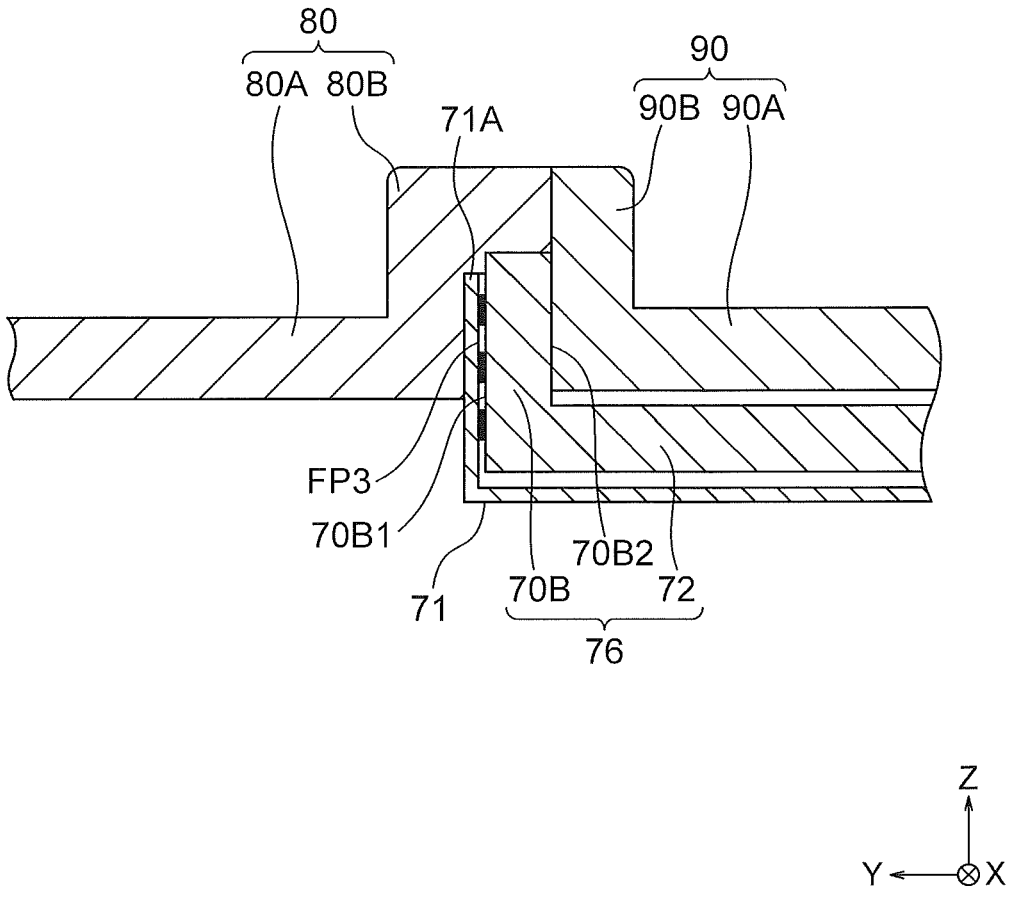
FIG. 18



DEVELOPER STORAGE BODY, IMAGE FORMING UNIT AND IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a developer storage body that stores a developer, and also relates to an image forming unit and an image forming apparatus including the developer storage body.

There is proposed a developer cartridge including a first storage chamber and a second storage chamber partitioned by a partition member. The first storage chamber stores a fresh developer. The second storage chamber stores a waste developer (see, for example, Japanese Patent No. 4086547).

In this regard, there is a demand for a developer storage body (such as a developer cartridge) that is simple in structure and easy to manufacture.

SUMMARY OF THE INVENTION

An aspect of the present invention is intended to provide a developer storage body, an image forming unit and an image forming apparatus which are simple in structure and easy to manufacture.

According to an aspect of the present invention, there is provided a developer storage body includes a first storage member, a second storage member, a frame and a resiliently deformable partition member. The first storage member includes a first opening and a first flange provided along an outer periphery of the first opening. The second storage member includes a second opening and a second flange provided along an outer periphery of the second opening so that the second flange faces the first flange. The frame includes a third flange held between the first flange and the second flange. A partition member includes a peripheral end portion mounted to the frame. The partition member and the first storage member form a first space portion therebetween. The partition member and the second storage member form a second space portion therebetween.

According to another aspect of the present invention, there is provided an image forming unit including the above described developer storage body that stores a developer, an image bearing body that bears a latent image, a developer bearing body that bears a developer and develops the latent image on the image bearing body, and a developer supply member that supplies the developer to the developer bearing body.

According to still another aspect of the present invention, there is provided an image forming apparatus including a medium feeding unit that feeds a medium, and the above described image forming unit that forms an image on the medium fed by the feeding unit.

With such a configuration, it becomes possible to provide a developer storage body, an image forming unit and an image forming apparatus which is small in size and light in weight.

BRIEF DESCRIPTION OF THE DRAWINGS

In the attached drawings:

FIG. **1** is a schematic sectional view showing an entire configuration of an image forming apparatus according to the embodiment of the present invention;

FIG. **2** is a schematic sectional view showing a configuration of an image forming unit of the image forming apparatus shown in FIG. **1**;

FIG. **3** is an exploded perspective view showing a toner cartridge of the image forming unit shown in FIG. **2**;

FIG. **4** is an enlarged sectional view showing a part of the image forming unit indicated by a circle IV in FIG. **2**;

FIG. **5** is a perspective view showing a frame and a partition member of the toner cartridge shown in FIG. **3**;

FIG. **6** is a perspective view showing an external configuration of the image forming unit shown in FIG. **2**;

FIG. **7** is a partially cutaway perspective view showing an internal configuration of the image forming unit shown in FIG. **6**;

FIG. **8** is an enlarged sectional view showing a part of the image forming unit shown in FIG. **2**;

FIG. **9** is an enlarged sectional view showing a part of the image forming unit indicated by a circle IX in FIG. **8**;

FIG. **10** is a perspective view showing an agitation shutter member of the image forming unit shown in FIG. **2**;

FIG. **11** is an exploded perspective view showing components of the toner cartridge shown in FIG. **3**;

FIG. **12** is an enlarged sectional view showing a part of the toner cartridge shown in FIG. **3**;

FIG. **13** is a sectional view showing a state of the toner cartridge of the embodiment just after a waste toner recovery operation is started;

FIG. **14** is a sectional view showing a state of the toner cartridge of the embodiment when the partition member deforms after the waste toner recovery operation is started;

FIG. **15** is a partially cutaway perspective view showing the toner cartridge in the state shown in FIG. **14**;

FIG. **16** is a sectional view showing a state of the toner cartridge when a replacement time is reached;

FIG. **17** is a partially cutaway perspective view showing the toner cartridge in the state shown in FIG. **16**; and

FIG. **18** is an enlarged sectional view showing a part of a toner cartridge according to a modification of the embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Embodiments of the present invention will be described with reference to the attached drawings. In the following description, examples of the present invention will be described, but the present invention is not limited to these examples. Further, the present invention is not limited to arrangements, dimensions, dimensional ratios or the like of respective elements shown in the drawings.

Hereinafter, an image forming apparatus including a toner cartridge (i.e., a developer storage body) according to the embodiment will be first described. Then, a modification, i.e., an example in which a partition member (together with a frame) is held between two storage members will be described.

Embodiment

Configuration of Image Forming Apparatus

FIG. **1** is a schematic sectional view showing an entire configuration of an image forming apparatus according to the embodiment of the present invention. The image forming apparatus is, for example, a printer that forms an image (for example, a color image) using an electrophotography on a medium (i.e., a printing medium) PM such as a paper. The image forming apparatus includes a medium feeding unit **1**, a transport unit **2**, an image forming section **3**, a transfer unit **4**, a fixing unit **5**, an ejection unit **6**, and an inverting unit **7**.

These elements are housed in a casing **100**. A path along which the medium PM is transported is defined as a transport path. Terms "upstream" and "downstream" are defined with reference to the transport path. To be more specific, the term "upstream" is used to indicate a direction toward (or a position closer to) the medium feeding unit **1** along the transport path. The term "downstream" is used to indicate a direction away from (or a position farther from) the medium feeding unit **1** along the transport path. The term "transport direction F" is used to indicate a direction in which the medium PM is transported along the transport path (i.e., a direction from upstream to downstream). The term "widthwise direction" is used to indicate a direction (parallel to an X direction shown in FIG. **1**) parallel to a surface of the medium PM transported along the transport path and perpendicular to the transport direction F. A dimension in the transport direction F will be referred to as a length. A dimension in the widthwise direction will be referred to as a width.

<Medium Feeding Unit **1**>

The medium feeding unit **1** is configured to feed the media PM one by one to the transport unit **2**. The medium feeding unit **1** includes, for example, a feeding tray **11**, a pickup roller **12**, a feeding roller **13**, and a retard roller **14**. The feeding tray **11** stores a stack of a plurality of the media PM. The feeding tray **11** is detachably mounted to, for example, a lower part of the image forming apparatus. The pickup roller **12**, the feeding roller **13** and the retard roller **14** rotate to feed the individual medium PM from the feeding tray **11** into the transport path toward the transport unit **2**. The pickup roller **12** and the feeding roller **13** are driven under control of a control unit (not shown), and rotate in a direction in which the pickup roller **12** and the feeding roller **13** feed the medium PM toward the transport unit **2**. The pickup roller **12** is disposed at a position where the pickup roller **12** contacts an upper surface of the uppermost medium PM of the stack. The feeding roller **13** is disposed downstream of the pickup roller **12**. The retard roller **14** prevents two or more media PM from being fed at the same time. The retard roller **14** is disposed at a position facing the feeding roller **13**, and rotates in the same rotating direction as a rotating direction of the feeding roller **13** (so that circumferential surfaces of the feeding roller **13** and the retard roller **14** move in opposite directions at a portion where the rollers **13** and **14** face each other).

<Transport Unit **2**>

The transport unit **2** is configured to correct a skew of the medium PM fed from the medium feeding unit **1**, and transport the medium PM along the transfer path toward the image forming section **3** and the transfer unit **4**. The transport unit **2** includes, for example, two pairs of registration rollers **21** and **22**.

<Image Forming Section **3**>

The image forming section **3** is configured to form an image on the medium PM transported from the transport unit **2**.

The image forming section **3** includes, for example, four image forming units (i.e., process units) **30**Y, **30**M, **30**C and **30**K as shown in FIG. **1**. The image forming units **30**Y, **30**M, **30**C and **30**K form toner images (i.e., developer images) using toners T of respective colors, i.e., a yellow toner, a magenta toner, a cyan toner and a black toner. The image forming units **30**Y, **30**M, **30**C and **30**K are arranged in this order along the transport direction F.

The image forming units **30**Y, **30**M, **30**C and **30**K have the same configuration except for the toners, and therefore are collectively referred to as the "image forming unit **30**".

FIG. **2** is a schematic sectional view showing a configuration of the image forming unit **30** (i.e., each of the image forming units **30**Y, **30**M, **30**C and **30**K). Each image forming unit **30** includes, for example, a main body **30**A and a toner cartridge **30**B (i.e., a developer storage body) disposed at an upper part of the main body **30**A as shown in FIG. **2**. The main body **30**A includes a photosensitive drum **32**, a charging roller **33**, a developing roller **35**, a supply roller **36**, a cleaning blade **37**, a waste toner conveying member **38** and agitation members **39**A and **39**B. These elements are enclosed by a cover **31** (i.e., an enclosure) of the main body **30**A. An LED (Light Emitting Diode) head **34** is disposed outside the cover **31** so as to face the photosensitive drum **32** via a window **31**A. A detailed description of the image forming unit **30** will be made later.

<Transfer Unit **4**>

Referring back to FIG. **1**, the transfer unit **4** is also referred to as a transfer belt unit. The transfer unit **4** includes a transfer belt **41**, a driving roller **42** that rotates to drive the transfer belt **41**, a driven roller **43** that rotates following a rotation of the driving roller **42**, and transfer rollers **44** (i.e., transfer members) provided so as to face the photosensitive drums **32** via the transfer belt **41**. The driving roller **42** and the driven roller **43** are cylindrical members respectively rotatable about rotation shafts extending in the widthwise direction. The transfer unit **4** transports the medium PM (having been fed from the transport unit **2**) in the transport direction F, and transfers the toner images from the photosensitive drums **32** of the image forming units **30**Y, **30**M, **30**C and **30**K to the surface of the medium PM.

The transfer belt **41** is an endless resilient belt composed of, for example, resin material such as polyimide resin. The transfer belt **41** is stretched around the driving roller **42** and the driven roller **43**. The driving roller **42** is driven by a motor (not shown) under control of the control unit (not shown), and rotates in a direction in which the transfer belt **41** transports the medium PM in the transport direction F. The driving roller **42** is disposed downstream of the image forming units **30**Y, **30**M, **30**C and **30**K. The driven roller **43** is biased by a biasing member (not shown), and applies a tension to the transfer belt **41**. The driven roller **43** rotates in the same rotating direction as the driving roller **42**. The driven roller **43** is disposed upstream of the image forming units **30**Y, **30**M, **30**C and **30**K.

The transfer rollers **44** rotate in a rotating direction opposite to a rotating direction of the photosensitive drums **32** of the image forming units **30**Y, **30**M, **30**C and **30**K, and transport the medium PM in the transport direction F. Further, the transfer rollers **44** electrostatically transfer the toner images from the photosensitive drums **32** to the medium PM. Each of the transfer rollers **44** is formed of, for example, a foamed semiconductive rubber.

<Fixing Unit **5**>

The fixing unit **5** is configured to fix the toner image (having been transferred to the medium PM by the transfer unit **4**) to the medium PM by applying heat and pressure thereto. The fixing unit **5** includes, for example, an upper roller **51** and a lower roller **52**.

Each of the upper roller **51** and the lower roller **52** include a heater (for example, a halogen lamp) as an internal heat source, and functions as a heating roller that applies heat to the toner image on the medium PM. The upper roller **51** is driven under control of the control unit (not shown), and rotates in a direction in which the upper roller **51** transports the medium PM in the transport direction F. The heaters provided in the upper roller **51** and the lower roller **52** are applied with bias voltages controlled by the control unit, and

surface temperatures of the upper roller **51** and the lower roller **52** are controlled by the control unit. The lower roller **52** is provided facing the upper roller **51** so as to form a nip portion therebetween. The lower roller **52** functions as a pressure roller that applies a pressure to the toner image on the medium PM. The lower roller **52** preferably has a surface layer composed of resilient (elastic) material.

<Ejection Unit **6**>

The ejection unit **6** is configured to eject the medium PM (to which the toner image has been fixed by the fixing unit **5**) to outside. The ejection unit **6** includes, for example, two pairs of transport roller **61** and **62**. The transport rollers **61** and **62** transport the medium PM through the transport path, and eject the medium PM to outside. The ejected medium PM is placed on a stacker **100**A provided outside the casing **100**. The transport rollers **61** and **62** are driven under control of the control unit, and rotate in a direction in which the transport rollers **61** and **62** transport the medium PM in the transport direction F.

<Inverting Unit **7**>

The inverting unit **7** inverts the medium PM (having passed the fixing unit **5**) upside-down, and transports the medium PM back to the transport unit **2**. The medium PM transported by the inverting unit **7** reaches the transport unit **2**, and is further transported through the image forming section **3** and the transfer unit **4** in such an orientation that a printed surface (i.e., a surface on which the toner image has been formed) faces downward. In other words, the inverting unit **7** enables the image forming apparatus to perform a duplex printing.

<Image Forming Unit **30**>

Configurations of the image forming unit **30** (i.e., each of the image forming units **30**Y, **30**M, **30**C and **30**K) will be described in detail with reference to FIG. **2**.

In the image forming unit **30**, the photosensitive drum **32** (i.e., an image bearing body) is a cylindrical member having a surface layer capable of bearing a latent image. The surface layer is composed of a photosensitive body (for example, an organic photosensitive body). To be more specific, the photosensitive drum **32** includes a conductive support and a photoconductive layer covering a circumferential surface of the conductive support. The conductive support is formed of, for example, a metal pipe of aluminum. The photoconductive layer has, for example, a layered structure including a charge generation layer and a charge transport layer. The photosensitive drum **32** is driven under control of the control unit, and rotates at a predetermined circumferential speed in a direction (shown by an arrow R**32** in FIG. **2**) in which the photosensitive drum **32** transports the medium PM in the transport direction F.

The charging roller **33** (i.e., a charging member) is configured to uniformly charge a surface (i.e., a circumferential surface, or the above described surface layer) of the photosensitive drum **32**. The charging roller **33** contacts the surface of the photosensitive drum **32**. The charging roller **33** includes, for example, a metal shaft and a semiconductive rubber layer (for example, a semiconductive epichlorohydrin rubber layer) covering a circumferential surface of the metal shaft. The charging roller **33** is driven under control of the control unit, and rotates in a direction (shown by an arrow R**33**) opposite to a rotating direction of the photosensitive drum **32**.

The LED head **34** (i.e., an exposing device) is configured to form an electrostatic latent image on the surface (i.e., the surface layer) of the photosensitive drum **32** by exposing the surface of the photosensitive drum **32**. The LED head **34** includes, for example, a plurality of LED elements (i.e., light emission elements) arranged in the widthwise direction and facing the photosensitive drum **32**, and a lens array that focus light beams (emitted by the LED elements) on the surface of the photosensitive drum **32**.

The developing roller **35** (i.e., a developer bearing body) is configured to bear a toner T as a developer on a surface thereof for developing the latent image. The developing roller **35** is disposed so as to contact the surface of the photosensitive drum **32**. The developing roller **35** includes, for example, a metal shaft and a semiconductive urethane rubber layer covering a circumferential surface of the metal shaft. The developing roller **35** is driven under control of the control unit, and rotates at a predetermined circumferential speed in the same rotating direction (shown by an arrow R**35** in FIG. **2**) as the rotating direction of the photosensitive drum **32**.

The supply roller **36** (i.e., a supply member) is configured to supply the toner T to the developing roller **35**. The supply roller **36** is disposed so as to contact a circumferential surface of the developing roller **35**. The supply roller **36** includes, for example, a metal shaft and a foamed silicone-rubber layer covering a circumferential surface of the metal layer. The supply roller **36** is driven under control of the control unit, and rotates in the same rotating direction (shown by an arrow R**36** in FIG. **2**) as the rotating direction of the developing roller **35**.

The cleaning blade **37** (i.e., a cleaning member) is configured to scrape off the toner T remaining on the surface of the photosensitive drum **32**. The cleaning blade **37** is formed of, for example, material having flexibility such as rubber or plastic.

The waste toner conveying member **38** (i.e., a waste developer conveying member) is driven under control of the control unit, and conveys the toner T (hereinafter referred to as a waste toner T**2**) scraped off by the cleaning blade **37**. The waste toner conveying member **38** conveys the waste toner T**2** by rotating, for example, in a direction shown by an arrow R**38** in FIG. **2**. The waste toner conveying member **38** conveys the waste toner T**2** to a waste toner storage chamber **90**S provided in the toner cartridge **30**B.

The toner cartridge **30**B includes a toner storage chamber **80**S storing the toner T of one of the above described four colors. To be more specific, the toner cartridge **30**B of the image forming unit **30**Y stores the yellow toner. The toner cartridge **30**B of the image forming unit **30**M stores the magenta toner. The toner cartridge **30**B of the image forming unit **30**C stores the cyan toner. The toner cartridge **30**B of the image forming unit **30**K stores the black toner. An agitation member **81** and an agitation shutter member **82** are provided in the toner cartridge **30**B. The agitation member **81** and the agitation shutter member **82** agitate the toner T by rotating in directions respectively shown by arrows R**81** and R**82** in FIG. **2**. A toner supply opening **83** is formed on a bottom of the toner cartridge **30**B. The toner supply opening **83** allows the toner T to be supplied to a toner agitation chamber **39**C (i.e., a developer reservoir) provided below the toner cartridge **30**B. In this regard, the agitation shutter member **82** also functions as a shutter that opens and closes the toner supply opening **83** by rotating in the direction shown by the arrow R**82** in FIG. **2**. In the toner agitation chamber **39**C, the agitation members **39**A and **39**B are disposed in the vicinity of the supply roller **36**. The agitation members **39**A and **39**B agitate the toner T supplied from the toner cartridge **30**B by rotating in directions respectively shown by arrows R**39**A and R**39**B in FIG. **2**.

In this regard, the toner cartridge **30**B may be formed integrally with the main body **30**A. Alternatively, the toner

cartridge **30**B may be formed separately from the main body **30**A, and may be configured to be detachably mounted to the main body **30**A.

<Configuration of Toner Cartridge **30**A>

Next, a configuration of the toner cartridge **30**B will be described with reference to FIG. **2** through **17**. FIG. **3** is an exploded perspective view showing main components of the toner cartridge **30**B. FIG. **4** is a sectional view showing a part indicated by a circle IV (shown by a dashed line) in FIG. **2**. FIG. **5** is a perspective view showing outer shapes of a frame **70** and a partition member **71** described later. FIG. **6** is a perspective view showing an external configuration of the image forming unit **30** including the toner cartridge **30**B. FIG. **7** is a partially cutaway perspective view showing an internal configuration of the image forming unit **30**. FIG. **8** is an enlarged sectional view showing a lower part of the toner cartridge **30**B. FIG. **9** is an enlarged sectional view showing a part indicated by a circle IX (shown by a dashed line) in FIG. **8**. FIG. **10** is a perspective view showing an outer shape of the agitation shutter member **82**. FIG. **11** is an exploded perspective view showing outer shapes of the frame **70** and a storage member **90** (described later) of the toner cartridge **30**B. FIG. **12** is an enlarged sectional view showing a connecting portion between the frame **70** and the storage member **90**.

As shown in FIG. **3**, the toner cartridge **30**B includes the storage member **80** (i.e., a first storage member), the storage member **90** (i.e., a second storage member), the frame **70**, and the partition member **71**. The frame **70** is held between the storage member **80** and the storage member **90**. The partition member **71** has a peripheral end portion **71**A fixed to an outer frame **72** (described later) of the frame **70**. The partition member **71** is resiliently deformable.

The storage member **80** includes a main body **80**A (i.e., a first main body) having an opening **80**K (i.e., a first opening), and a flange **80**B (i.e., a first flange) provided along an outer periphery of the opening **80**K. The flange **80**B extends so as to surround the opening **80**K. The storage member **90** includes a main body **90**A (i.e., a second main body) having an opening **90**K (i.e., a second opening), and a flange **90**B (i.e., a second flange) provided along the outer periphery of the opening **90**K so as to face the flange **80**B. The flange **90**B extends so as to surround the opening **90**K. The frame **70** includes the outer frame **72** and a flange **70**B (i.e., a third flange) provided along an outer periphery of the outer frame **72**. The flange **70**B extends so as to surround the outer frame **72**. The flange **70**B protrudes outward from the outer frame **72**. The frame **70** is formed of resin such as, for example, high density polyethylene (HDPE) that has a higher hardness than the partition member **71**.

As shown in FIG. **4**, the flange **70**B is held (sandwiched) between the flange **80**B and the flange **90**B. The flange **80**B has a step portion including a surface **801** that contacts the flange **90**B, and a surface **802** retracted from the surface **801** by a distance D. The surface **802** of the flange **80**B contacts a surface **70**B**1** of the flange **70**B. The flange **90**B includes a surface **901** that contacts the surface **801** of the flange **80**B. The surface **901** of the flange **90**B faces the surface **802** of the flange **80**B with a gap of the distance D. The flange **70**B is disposed between the surface **901** of the flange **90**B and the surface **802** of the flange **80**B.

A fixing portion FP**1** is formed between the surface **801** of the flange **80**B and the surface **901** of the flange **90**B. The surface **801** of the flange **80**B and the surface **901** of the flange **90**B are tightly fixed to each other at the fixing portion FP**1** by heat welding, ultrasonic welding or the like. Further, a fixing portion FP**2** is formed between a surface **70**B**2** of the flange **70**B and the surface **901** of the flange **90**B. It is preferable that the surface **70**B**2** of the flange **70**B and the surface **901** of the flange **90**B are tightly fixed to each other at the fixing portion FP**2** by heat welding, ultrasonic welding, or the like. In this regard, it is preferable that a width W (FIG. **4**) of the flange **70**B is substantially the same as or slightly smaller than the distance D. This is because the flange **80**B and the flange **90**B can be firmly fixed to each other, and the flange **70**B can be sufficiently fixed by being held between the flange **80**B and the flange **90**B. Further, this is because the fixing portion FP**1** and the fixing portion FP**2** can be formed at the same time in a manufacturing process.

The partition member **71** includes the peripheral end portion **71**A fixed to the outer frame **72** of the frame **70** (FIGS. **4** and **5**). The partition member **71** partitions an inner space of the toner cartridge **30**B (formed by the storage member **80** and the storage member **90**) into two chambers, i.e., a toner storage chamber **80**S (i.e., a first space portion) and a waste toner storage chamber **90**S (i.e., a second space portion) as shown in FIG. **2**. To be more specific, the toner storage chamber **80**S is formed between the partition member **71** and the storage member **80**. The waste toner storage chamber **90**S is formed between the partition member **71** and the storage member **90**. The partition member **71** resiliently deforms according to a volume of the toner T stored in the toner storage chamber **80**S, and a volume of the waste toner T**2** stored in the waste toner storage chamber **90**S. The partition member **71** is formed of, for example, a film composed of resin which is softer than the frame **70**. The partition member **71** is preferably formed of a film of low-density-polyethylene (LDPE) having a thickness in a range approximately from 0.1 mm to 0.4 mm. The peripheral end portion **71**A of the partition member **71** is fixed to the outer frame **72** at a fixing portion FP**3** by heat welding, bonding material or the like. Since the peripheral end portion **71**A is fixed to the outer frame **72** (i.e., a part of the frame **70** different from the flange **70**B), gaps between any two of the flange **70**B, the flange **80**B and the flange **90**B can be minimized.

The frame **70** further includes a beam **73**, ribs **74** and ribs **75** as shown in FIGS. **3**, **4** and **5**. The beam **73** extends in the widthwise direction and crosses a space surrounded by the outer frame **72**. The ribs **74** extend to connect an upper part of the outer frame **72** with the beam **73**. The ribs **75** extend to connect a lower part of the outer frame **72** with the beam **73**. The outer frame **72**, the beam **73** and the ribs **74** have shapes along an inner surface of the main body **90**A of the storage member **90**. In contrast, the ribs **75** are distanced from the inner surface of the main body **90**A of the storage member **90**. The number of the beam **73** may be one, two or more. The number of the ribs **74** may be one, two or more. The number of the ribs **75** may be one, two or more. The frame **70** does not have a single plate shape, but has a skeleton structure (i.e., a framework structure) including the outer frame **72**, the beam **73** and the ribs **74** and **75**. Therefore, the frame **70** can be light in weight and have a strength.

A waste toner conveying member **91** (i.e., a waste developer conveying member) and a driving member **92** are provided between the ribs **75** of the frame **70** and the main body **90**A of the storage member **90** (FIGS. **7** through **9**). The waste toner conveying member **91** extends in the widthwise direction (i.e., the X direction). The driving member **92** is provided for driving the waste toner conveying member **91**. The waste toner conveying member **91** and the driving member **92** are rotatably supported by holding

portions **93** and holding portions **75**A. The holding portions **93** are provided on an inner surface of the main body **90**A of the storage member **90**. The holding portions **75**A (FIG. **9**) are provided on outer surfaces of the ribs **75** of the frame **70**. An end of the waste toner conveying member **91** is connected to the driving member **92**. The waste toner conveying member **91** further extends to reach a lower part of the main body **30**A, and the other end of the waste toner conveying member **91** is connected to the waste toner conveying member **38**. The waste toner conveying member **38** extends in the widthwise direction in the lower part of the main body **30**A (FIG. **7**).

Moreover, the frame **70** further includes a partition portion **72**A formed at a lower part of the outer frame **72**. The partition portion **72**A has a curved inner surface **72**AS (FIGS. **7** and **8**). The toner supply opening **83** is formed by the partition portion **72**A and the main body **80**A of the storage member **80**.

The agitation shutter member **82** is disposed at a lower part in the toner storage chamber **80**S (FIGS. **2**, **8** and **10**). The agitation shutter member **82** includes films **82**A, **82**B, **82**C and **82**D as shown in FIGS. **8** and **10**. According to a rotational position of the agitation shutter member **82**, the films **82**A, **82**B, **82**C and **82**D contact an inner surface **80**AS of the main body **80**A and the inner surface **72**AS of the partition portion **72**A so as to prevent an excessive amount of the toner T from falling into the toner agitation chamber **39**C via the toner supply opening **83**.

Further, when the agitation shutter member **82** rotates in the direction shown by the arrow R**82**, the films **82**A, **82**B, **82**C and **82**D sweep the inner surfaces **80**AS and **72**AS, and scrape off the toner T adhering to the inner surfaces **80**AS and **72**AS. Therefore, the toner T is supplied to the toner agitation chamber **39**C via the toner supply opening **83**.

Further, as shown in FIGS. **11** and **12**, the partition portion **72**A of the frame **70** is preferably connected to a lower part of the storage member **90**. To be more specific, cylindrical portions having cylindrical holes **72**B protrude from the partition portion **72**A in a direction opposite to the inner surface **72**AS. Posts **94** protrude from a lower part of the inner surface of the main body **90**A, and engage the holes **72**B. With the engagement between the posts **94** and the holes **72**B, the frame **70** is firmly fixed to the storage member **90**. Therefore, for example, the waste toner conveying member **91** is stably supported, and the waste toner T**2** is stably conveyed.

<Operation and Function>

<Image Forming Operation>

The image forming apparatus of this embodiment forms a toner image on the medium PM as described below.

In a state where the image forming apparatus is powered ON, when the control unit (not shown) of the image forming apparatus receives a print command and print image data from a host device such as a personal computer, the control unit starts a printing operation (i.e., an image forming operation) of the print image data according to the print command.

For example, as shown in FIG. **1**, the pickup roller **12** rotates to pick up the uppermost medium PM of the media PM stored in the feeding tray **11**. The feeding roller **13** and the retard roller **14** feed the individual medium PM into the transport path toward the transport unit **2**. In the transport unit **2**, the registration rollers **21** correct the skew of the medium PM, and transport the medium PM downstream along the transport path. Further, the registration rollers **22** transport the medium PM toward the image forming section **3** and the transfer unit **4**. Then, the medium PM is transported by the transfer belt **41** of the transfer unit **4**, and passes the image forming units **30**Y, **30**M, **30**C and **30**K of the image forming section **3**.

In the image forming units **30** (i.e., in each of the image forming units **30**Y, **30**M, **30**C and **30**K), a toner image is formed by an electrophotographic process as described below. The control unit causes the agitation member **81** and the agitation shutter member **82** to rotate in directions respectively shown by the arrows R**81** and R**82**. As the agitation member **81** and the agitation shutter member **82** rotate, the toner T stored in the toner storage chamber **80**S is agitated, and is supplied to the toner agitation chamber **39**C via the toner supply opening **83**.

Further, the control unit causes the photosensitive drum **32** to rotate, for example, in the direction shown by the arrow R**32** (FIG. **2**) at a constant circumferential speed. A rotation of the photosensitive drum **32** is transmitted to the agitation members **39**A and **39**B, the supply roller **36**, the developing roller **35**, and the charging roller **33** via a power transmission mechanism such as a gear train. Therefore, the agitation members **39**A and **39**B, the supply roller **36**, the developing roller **35** and the charging roller **33** respectively rotate in directions shown by the arrows R**39**A, R**39**B, R**36**, R**35** and R**33** in FIG. **1**.

The control unit applies a predetermined voltage to the charging roller **33**, and uniformly charges the surface of the photosensitive drum **32**. Then, the control unit causes the LED head **34** to emit light based on a color component of the print image data so as to expose the surface of the photosensitive drum **32**. Therefore, an electrostatic latent image is formed on the surface of the photosensitive drum **32**.

The toner T agitated by the agitation members **39**A and **39**B is supplied to the developing roller **35** via the supply roller **36**. The developing roller **35** bears the toner T on the surface thereof, and makes the toner T adhere to the latent image on the photosensitive drum **32** to form the toner image. Further, the transfer roller **44** of the transfer unit **4** is applied with a predetermined voltage, and an electric field occurs between the photosensitive drum **32** and the transfer roller **44**. With the electric field, the toner image is transferred from the photosensitive drum **32** to the medium PM transported through between the photosensitive drum **32** and the transfer roller **44**.

After the toner images formed in the image forming units **30**Y, **30**M, **30**C and **30**K are transferred to the medium PM, the medium PM is transferred by the transfer belt **41** to the fixing unit **5**.

The fixing unit **5** applies heat and pressure to the toner image (having been transferred to the medium PM) to fix the toner image to the medium PM. The ejection unit **6** ejects the medium PM with the fixed toner image to the stacker **100**A outside the image forming apparatus.

<Recovery Operation of Waste Toner T**2**>

A recovery operation of the waste toner T**2** in the image forming unit **30** of this embodiment will be described with reference to FIGS. **2**, **7** and **13** through **17**. In the image forming unit **30**, after the toner image on the photosensitive drum **32** is transferred to the medium PM, the toner T remaining on the photosensitive drum **32** is scraped off by the cleaning blade **37**. The toner T (i.e., the waste toner T**2**) scraped off by the cleaning blade **37** is eventually stored in the waste toner storage chamber **90**S as shown in FIG. **13**. In this regard, FIG. **13** shows a state (i.e., an initial state) where a large amount of the toner T (i.e., a fresh toner) remains in the toner storage chamber **80**S, and a small amount of the waste toner T**2** is stored in the waste toner storage chamber **90**S.

The waste toner T2 scraped off by the cleaning blade 37 is first conveyed in the direction shown by an arrow Y38 in FIG. 7 by the rotation of the waste toner conveying member 38 in a direction shown by the arrow R38 (FIG. 2). Then, the waste toner T2 is conveyed to the waste toner storage chamber 90S by a rotation of the waste toner conveying member 91 (rotated by the driving member 92) in a direction shown by an arrow R91 (FIG. 2). The waste toner T2 is gradually deposited starting from the bottom of waste toner storage chamber 90S. As a number of printed media PM increases, an amount of the toner T (i.e., the fresh toner) decrease, and an amount of the waste toner T2 increases. As a result, the partition member 71 resiliently deforms as shown in FIGS. 14 and 15. FIG. 14 is a schematic sectional view of the image forming unit 30 and FIG. 15 is a partially cutaway perspective view of the toner cartridge 30B in a state where the partition member 71 deforms. The partition member 71 deforms, for example, in a direction shown by an arrow Y71 in FIG. 14 according to the volume of the toner T stored in the toner storage chamber 80S and the volume of the waste toner T2 stored in the waste toner storage chamber 90S. Therefore, a capacity of the toner storage chamber 80S decreases, and a capacity of the waste toner storage chamber 90S increases.

Eventually, as shown in FIGS. 16 and 17, the partition member 71 deforms to a state where the partition member 71 greatly protrudes into inside of the storage member 80 across a border of the storage member 80 and the storage member 90 where the frame 70 is disposed. FIG. 16 is a schematic sectional view of the image forming unit 30 and FIG. 17 is a partially cutaway perspective view of the toner cartridge 30B in a state where the toner T is completely ejected, and the waste toner storage chamber 90S is almost filled with the waste toner T2. That is, FIGS. 16 and 17 show the state where a replacement time of the toner cartridge 30B is reached.

Effects of Embodiment

The toner cartridge 30B of this embodiment includes the storage member 80 and the storage member 90 provided so as to hold the frame 70 therebetween, and the resiliently deformable partition member 71 is fixed to the frame 70. Therefore, the toner cartridge 30B has a simple structure, and can be assembled in a simple manner. In other words, the toner cartridge 30B is simple in structure and easy to manufacture. Further, the toner cartridge 30B exhibits a high sealing performance.

For example, in a conventional toner cartridge in which a partition member is inserted into a cylindrical container as disclosed in Japanese Patent No. 4086547, it is necessary to provide a gap between the partition member and the cylindrical container to allow the partition member to be inserted into the cylindrical container.

In contrast, the toner cartridge 30B of this embodiment can be manufactured by stacking the storage member 80, the frame 70 (to which the partition member 71 is fixed) and the storage member 90, and by fixing the storage member 80, the frame 70 and the storage member 90 to each other at contact portions (i.e., fixing portions FP1, FP2 and FP3) by a single process such as heat welding or the like. Therefore, a complex assembling process is unnecessary. Further, gaps between any two of the storage member 80, the frame 70 (to which the partition member 71 is fixed) and the storage member 90 can be reduced.

Further, in the configuration where the partition member is inserted into the cylindrical container as disclosed by the above described patent, the partition member is needed to have a strength so as to withstand an inserting operation into the cylindrical container. In contrast, according to the image forming apparatus of this embodiment, the partition member is not needed to have such a strength. Therefore, a thickness of the partition member can be reduced.

Modifications

Although the embodiment of the present invention has been described, the present invention is not limited to the embodiment, but various modification can be made. For example, although the image forming apparatus of the above described embodiment forms a color image, the present invention is also applicable to an image forming apparatus that forms a monochrome image such as, for example, a black toner image. Further, although the image forming apparatus of the above described embodiment employs a direct transfer system in which a developer image is directly transferred to a recording medium, the present invention is also applicable to an image forming apparatus employing an intermediate transfer system in which a developer image is transferred to a recording medium via an intermediate transfer body.

Further, in the above described embodiment, the peripheral end portion 71A of the partition member 71 is fixed to the outer frame 72 (i.e., a part different from the flange 70B) of the frame 70. However, the present invention is not limited to such a configuration. FIG. 18 shows a modification of this embodiment. A frame 76 shown in FIG. 18 includes the flange 70B having the surface 70B1 contacting the flange 80B of the storage member 80. In this modification, the peripheral end portion 71A of the partition member 71 is fixed to the surface 70B1 of the flange 70B. In this case, the fixing portion FP3 overlaps with a portion where the flange 80B of the storage member 80 and the flange 90B of the storage member 90 face each other. Therefore, an effective area (i.e., a deformable area) of the partition member 71 can be increased.

Further, although the image forming apparatus of the above described embodiment includes the LED head as the exposing device, it is also possible to employ other exposing devices such as a laser element or the like.

Further, the image forming apparatus of the above described embodiment has a printing function. However, the present invention is also applicable to, for example, an MFP (Multi-Function Peripheral) having, for example, a scanning function and a facsimile function in addition to the printing function.

While the preferred embodiments of the present invention have been illustrated in detail, it should be apparent that modifications and improvements may be made to the invention without departing from the spirit and scope of the invention as described in the following claims.

What is claimed is:

1. A developer storage body comprising:

a first storage member including a first opening and a first flange provided along an outer periphery of the first opening;

a second storage member including a second opening, and a second flange provided along an outer periphery of the second opening so that the second flange faces the first flange;

a frame including a third flange sandwiched by the first flange and the second flange; and

a resiliently deformable partition member including a peripheral end portion fixed to the frame,

wherein the partition member and the first storage member form a first space portion therebetween, and the partition member and the second storage member form a second space portion therebetween.

2. The developer storage body according to claim **1**, wherein the third flange protrudes outward from an outer surface of the frame.

3. The developer storage body according to claim **1**, wherein the partition member resiliently deforms according to a volume of a first developer stored in the first space portion and a volume of a second developer stored in the second space portion.

4. The developer storage body according to claim **1**, wherein the peripheral end portion of the partition member is fixed to a portion of the frame different from the third flange.

5. The developer storage body according to claim **1**, wherein the peripheral end portion of the partition member is fixed to the third flange.

6. The developer storage body according to claim **1**, wherein the first storage member includes a first main body on which the first opening is formed, and

wherein the second storage member includes a second main body on which the second opening is formed.

7. An image forming unit comprising:

the developer storage body according to claim **1**;

an image bearing body that bears a latent image on a surface thereof;

a developer bearing body that bears a developer and develops the latent image on the surface of the image bearing body; and

a developer supply member that supplies the developer to the developer bearing body.

8. An image forming apparatus comprising:

the image forming unit according to claim **7**; and

a medium feeding unit that feeds a medium to the image forming unit.

9. A developer storage body comprising:

a first storage member including a first opening and a first flange provided along an outer periphery of the first opening;

a second storage member including a second opening, and a second flange provided along an outer periphery of the second opening so that the second flange faces the first flange;

a frame including a third flange held between the first flange and the second flange; and

a resiliently deformable partition member including a peripheral end portion fixed to the frame,

wherein the partition member and the first storage member form a first space portion therebetween, and the partition member and the second storage member form a second space portion therebetween;

wherein the first flange includes a step portion including a first contact surface and a third contact surface retracted from the first contact surface;

wherein the second flange includes a second contact surface that contacts the first contact surface; and

wherein the second contact surface and the third contact surface face each other via the third flange inserted therebetween.

10. The developer storage body according to claim **9**, wherein the first contact surface and the second contact surface are welded to each other.

11. The developer storage body according to claim **9**, wherein a gap between the first contact surface and the third contact surface is substantially the same as a thickness of the third flange.

12. The developer storage body according to claim **11**, wherein the second contact surface is welded to both of the first contact surface and the third flange.

13. A developer storage body comprising:

a first storage member including a first opening and a first flange provided along an outer periphery of the first opening;

a second storage member including a second opening, and a second flange provided along an outer periphery of the second opening so that the second flange faces the first flange;

a frame including a third flange held between the first flange and the second flange; and

a resiliently deformable partition member including a peripheral end portion fixed to the third flange of the frame,

wherein the partition member and the first storage member form a first space portion therebetween, and the partition member and the second storage member form a second space portion therebetween.

14. The developer storage body according to claim **13**, wherein the third flange protrudes outward from an outer surface of the frame.

15. The developer storage body according to claim **13**, wherein the partition member resiliently deforms according to a volume of a first developer stored in the first space portion and a volume of a second developer stored in the second space portion.

16. The developer storage body according to claim **13**, wherein the first flange includes a step portion including a first contact surface and a third contact surface retracted from the first contact surface;

wherein the second flange includes a second contact surface that contacts the first contact surface; and

wherein the second contact surface and the third contact surface face each other via the third flange inserted therebetween.

17. The developer storage body according to claim **16**, wherein a gap between the first contact surface and the third contact surface is substantially the same as a thickness of the third flange.

18. The developer storage body according to claim **13**, wherein the first storage member includes a first main body on which the first opening is formed, and

wherein the second storage member includes a second main body on which the second opening is formed.

19. An image forming unit comprising:

the developer storage body according to claim **13**;

an image bearing body that bears a latent image on a surface thereof;

a developer bearing body that bears a developer and develops the latent image on the surface of the image bearing body; and

a developer supply member that supplies the developer to the developer bearing body.

20. An image forming apparatus comprising:

the image forming unit according to claim **19**; and

a medium feeding unit that feeds a medium to the image forming unit.

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